

ACKNOWLEDGMENT

The research was funded by Research and Community Service Centre, Diponegoro University, under Research for International Publication Grant.

REFERENCES

- [1] S. Settharaksa, C. Monton, and L. Charoenchai, "Optimization of *Caesalpinia sappan* L. heartwood extraction procedure to obtain the highest content of brazilin and greatest antibacterial activity," *J. Integr. Med.*, vol. 17, no. 5, pp. 351–358, 2019, doi: 10.1016/j.joim.2019.05.003.
- [2] P. Adirestuti *et al.*, "Optimization of Extraction from Sappan Wood and Its Influence on Food Bacterial Contaminants," *Indones. J. Pharm. Sci. Technol.*, vol. 1, no. 1, pp. 21–24, 2018.
- [3] L. Ngamwonglumlert, S. Devahastin, and N. Chiewchan, "Natural colorants: Pigment stability and extraction yield enhancement via utilization of appropriate pretreatment and extraction methods," *Crit. Rev. Food Sci. Nutr.*, vol. 57, no. 15, pp. 3243–3259, 2017, doi: 10.1080/10408398.2015.1109498.
- [4] L. Y. Hartiadi and A. A. T. Sahamastuti, "Protective effect of *Caesalpinia sappan* L. extract against H₂O₂-induced oxidative stress on hacat and its formulation as antioxidant cream," *J. Res. Pharm.*, vol. 24, no. 4, pp. 508–517, 2020, doi: 10.35333/jrp.2020.199.
- [5] A. Naik Bukke, F. Nazneen Hadi, K. S. Babu, and P. C. Shankar, "In vitro studies data on anticancer activity of *Caesalpinia sappan* L. heartwood and leaf extracts on MCF7 and A549 cell lines," *Data Br.*, vol. 19, pp. 868–877, 2018, doi: 10.1016/j.dib.2018.05.050.
- [6] I. Ahmad, A. E. Arifianti, A. S. Sakti, F. C. Saputri, and A. Mun'im, "Simultaneous Natural Deep Eutectic Solvent-Based Ultrasonic-Assisted Extraction of Bioactive Compounds of Cinnamon Bark and Sappan Wood as a Dipeptidyl Peptidase IV Inhibitor," *Molecules*, vol. 25, no. Dpp Iv, pp. 1–11, 2020.
- [7] L. Ngamwonglumlert, S. Devahastin, N. Chiewchan, and G. S. V. Raghavan, "Color and molecular structure alterations of brazilin extracted from *Caesalpinia sappan* L. under different pH and heating conditions," *Sci. Rep.*, 2020, doi: 10.1038/s41598-020-69189-3.
- [8] H. N. Lioe, D. R. Adawiyah, and R. Anggraeni, "Isolation and characterization of the major natural dyestuff component of brazilwood (*Caesalpinia sappan* L.)," *Int. Food Res. J.*, vol. 19, no. 2, pp. 537–542, 2012.
- [9] V. K. Sinsawasdi, "Sappanwood Water Extract: Evaluation of Color Properties, Functional Properties, and Toxicity," University of Florida, 2012.
- [10] I. Batubara, T. Mitsunaga, and H. Ohashi, "Screening antiacne potency of Indonesian medicinal plants: Antibacterial, lipase inhibition, and antioxidant activities," *J. Wood Sci.*, vol. 55, no. 3, pp. 230–235, 2009, doi: 10.1007/s10086-008-1021-1.
- [11] A. G., R. A.J.A., U. R. N. A., and C. Padmalatha, "Toxicological studies of *Caesalpinia sappan* wood derived dye in Wister albino rats," *Food Sci. Hum. Wellness*, 2017, doi: 10.1016/j.fshw.2016.10.004.
- [12] D. A. Nogueira, J. M. Da Silveira, É. M. Vidal, N. T. Ribeiro, and C. A. Veiga Burkert, "Cell Disruption of *Chaetoceros calcitrans* by Microwave and Ultrasound in Lipid Extraction," *Int. J. Chem. Eng.*, vol. 2018, 2018, doi: 10.1155/2018/9508723.
- [13] D. Panda and S. Manickam, "Cavitation technology-the future of greener extraction method: A review on the extraction of natural products and process intensification mechanism and perspectives," *Appl. Sci.*, vol. 9, no. 4, 2019, doi: 10.3390/app9040766.
- [14] J. Quintero Quiroz, A. M. Naranjo Duran, M. Silva Garcia, G. L. Ciro Gomez, and J. J. Rojas Camargo, "Ultrasound-assisted extraction of bioactive compounds from annatto seeds, evaluation of their antimicrobial and antioxidant activity, and identification of main compounds by LC/ESI-MS analysis," *Int. J. Food Sci.*, vol. 2019, pp. 5–7, 2019, doi: 10.1155/2019/3721828.
- [15] Z. Xia, D. Li, Q. Li, Y. Zhang, and W. Kang, "Simultaneous determination of brazilin and protosappanin B in *Caesalpinia sappan* by ionic-liquid dispersive liquid-phase microextraction method combined with HPLC," *Chem. Cent. J.*, vol. 11, no. 1, pp. 1–11, 2017, doi: 10.1186/s13065-017-0342-9.
- [16] O. R. Alara and N. H. Abdurahman, "Kinetics studies on effects of extraction techniques on bioactive compounds from *Vernonia cinerea* leaf," *J. Food Sci. Technol.*, vol. 56, no. 2, pp. 580–588, 2019, doi: 10.1007/s13197-018-3512-4.
- [17] H. A. Harouna-Oumarou, H. Fauduet, C. Porte, and Y. S. Ho, "Comparison of kinetic models for the aqueous solid-liquid extraction of *Tilia* sapwood a continuous stirred tank reactor," *Chem. Eng. Commun.*, vol. 194, no. 4, pp. 537–552, 2007, doi: 10.1080/00986440600992511.
- [18] T. Anggraini, S. Wilma, D. Syukri, and F. Azima, "Total phenolic, anthocyanin, catechins, DPPH radical scavenging activity, and toxicity of *leptanthes alata* (Blume) leenh," *Int. J. Food Sci.*, vol. 2019, 2019, doi: 10.1155/2019/9703176.
- [19] A. Altemimi, N. Lakhssassi, A. Baharlouei, D. G. Watson, and D. A. Lightfoot, "Phytochemicals: Extraction, isolation, and identification of bioactive compounds from plant extracts," *Plants*, vol. 6, no. 4, 2017, doi: 10.3390/plants6040042.
- [20] S. L. Rodriguez De Luna, R. E. Ramirez-Garza, and S. O. Serna Saldívar, "Environmentally Friendly Methods for Flavonoid Extraction from Plant Material: Impact of Their Operating Conditions on Yield and Antioxidant Properties," *Sci. World J.*, vol. 2020, 2020, doi: 10.1155/2020/6792069.
- [21] P. C. Setford, D. W. Jeffery, P. R. Grbin, and R. A. Muhlack, "Factors affecting extraction and evolution of phenolic compounds during red wine maceration and the role of process modelling," *Trends Food Sci. Technol.*, vol. 69, pp. 106–117, 2017, doi: 10.1016/j.tifs.2017.09.005.
- [22] I. S. Che Sulaiman, M. Basri, H. R. Fard Masoumi, W. J. Chee, S. E. Ashari, and M. Ismail, "Effects of temperature, time, and solvent ratio on the extraction of phenolic compounds and the anti-radical activity of *Clinacanthus nutans* Lindau leaves by response surface methodology," *Chem. Cent. J.*, vol. 11, no. 1, pp. 1–11, 2017, doi: 10.1186/s13065-017-0285-1.
- [23] N. A. A. R. Zahari, G. H. Chong, L. C. Abdullah, and B. L. Chua, "Ultrasonic-Assisted Extraction (UAE) Process on Thymol Concentration from *Plectranthus Amboinicus* Leaves: Kinetic Modeling and Optimization," *Processes*, vol. 8, no. 322, 2020.
- [24] M. Corrales, S. Toepfl, P. Butz, D. Knorr, and B. Tauscher, "Extraction of anthocyanins from grape by-products assisted by ultrasonics, high hydrostatic pressure or pulsed electric fields: A comparison," *Innov. Food Sci. Emerg. Technol.*, vol. 9, no. 1, pp. 85–91, 2008, doi: 10.1016/j.ifset.2007.06.002.
- [25] L. Zhong, Y. Liu, B. Xiong, L. Chen, Y. Zhang, and C. Li, "Optimization of Ultrasound-Assisted Extraction of Total Flavonoids from *Dendranthema indicum* var. *aromaticum* by Response Surface Methodology," *J. Anal. Methods Chem.*, vol. 2019, 2019, doi: 10.1155/2019/1648782.
- [26] S. Warinhomhaun, B. Sritularak, and D. Charnvanich, "A simple high-performance liquid chromatographic method for quantitative analysis of brazilin in *caesalpinia sappan* L. extracts," *Thai J. Pharm. Sci.*, vol. 42, no. 4, pp. 208–213, 2018.
- [27] D. R. Joshi and N. Adhikari, "An Overview on Common Organic Solvents and Their Toxicity," *J. Pharm. Res. Int.*, vol. 28, no. 3, pp. 1–18, 2019, doi: 10.9734/jpri/2019/v28i330203.
- [28] Y. Sasaki, T. Hosokawa, M. Nagai, and S. Nagumo, "In vitro study for inhibition of NO production about constituents of Sappan lignum," *Biol. Pharm. Bull.*, vol. 30, no. 1, pp. 193–196, 2007, doi: 10.1248/bpb.30.193.